CUMANA

DISK DRIVE GUIDE

BBC

CUMANA®

The Cumana Disk Drive Guide for the BBC Microcomputer

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A Cumana Publication

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Contents

Preface

The aim of this book is to introduce the newcomer to the theory and operation of floppy disk drives when used with the BBC micro-computer.

Note:

Users of the Cumana QFS disk filing system should read their 'QFS USERS HANDBOOK' before proceeding with this book.

We begin by taking a brief look at various data storage techniques and the role that each play within the computing environment. From there we move on to the mechanics of a disk drive, and how each disk drive can differ in type shape and size. Particular attention is paid to the popular slim-line 5¼ inch disk drive, however a later chapter has been added to cover the 3½ inch mini-floppy disk drive.

Moving on we explain how to connect your disk drive to the host BBC micro, followed by a short test to make sure that all is well.

Finally, we end with a detailed look at the BBC micro's own disk filing system (DFS) commands with examples showing how to use them.

WARNING

CSX and CDX series disk drives are designed to plug into the BBC micro-computers auxiliary D.C. Power socket.

Connecting to any other form of power source may result in irreparable damage and invalidate warranty.

Warning: This Equipment must be earthed.

IMPORTANT: The wires in the mains lead for the disk drive are coloured in accordance with the following code:

GREEN AND YELLOW.....EARTH
BLUE..... NEUTRAL
BROWN.....LIVE

SEE DIAGRAM OVERLEAF.

The colours of the wires in the mains lead may not correspond with the colours or markings identifying the terminals in your plug, therefore proceed as follows:

The wire coloured green and yellow must be connected to the terminal marked with either the letter E (or the earth symbol) and/or coloured green (or green and yellow).

The wire coloured blue must be connected to the terminal marked with either the letter N, and/or coloured black (or blue).

The wire coloured brown must be connected to the terminal marked with either the letter L, and/or coloured red (or Brown).

If the socket outlet available to you is not suitable for the plug supplied, the plug should be cut cleanly off and disposed of immediately. The exposed mains wires cause a potential shock hazard if the moulded plug were to be plugged in.

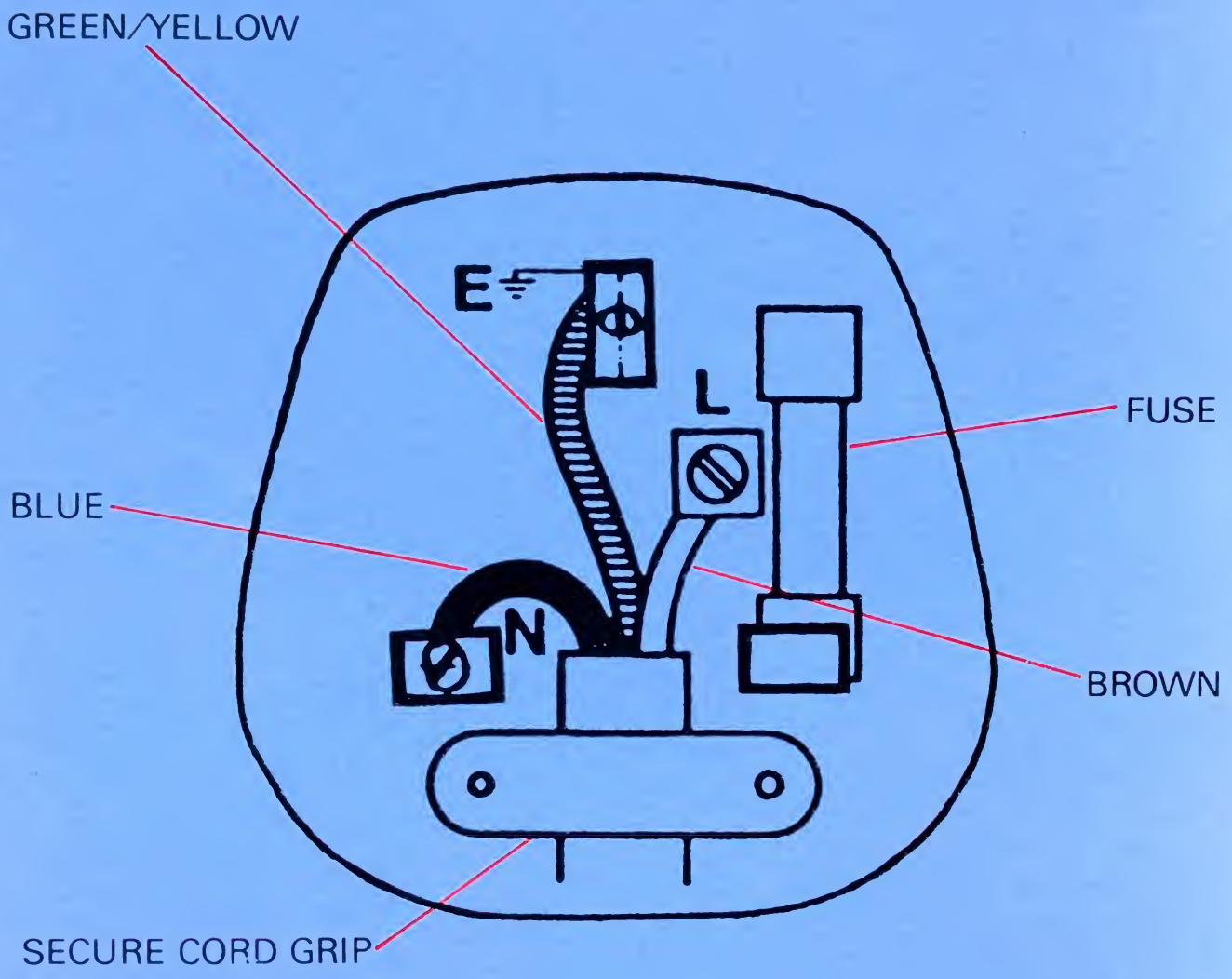
The moulded plug must only be used with the fuse and fuse carrier firmly in place. Plugs and fuse carriers from other manufacturers are not inter-changable. If the plug or fuse carrier should become damaged, or the fuse carrier lost, the plug should be replaced in accordance with the directions above. The plug MUST NOT be used without a suitable fuse carrier. Should the fuse blow, the fault must first be remedied and the fuse replaced with a 3 AMP fuse that is ASTA approved to BS1362.
If in doubt consult a qualified electrician.

Warning

There are no user servicable parts inside a CUMANA disk drive. Before attempting to remove the lid be sure to isolate the unit by switching off at the mains and removing the plug from the main supply.

Red/Brown	To	Live
Black/Blue	To	Neutral
Green/Green&Yellow	To	Earth

FIT WITH A 3 AMP FUSE To BS 1362



Under no circumstances is the earth to be removed as damage could result to both computer and floppy disk drive, as well as the possible danger of electrocution.

If in doubt please consult a fully qualified electrician.

Chapter 1

Data Storage

There are a variety of devices in which data can be stored, and in general they are referred to as MEMORY.

Memory size is normally measured in kilo-bytes where one byte is eight bits of one word. Incidentally half a byte is a nibble (four bits).

The BBC micro model B has 32 kilo-bytes of user memory known as RAM or Random Access Memory, and as the name suggests can be used in a number of different ways. The RAM normally holds the current program and its variables which is either under execution or at some stage of development. As a new program is needed it is loaded into the same RAM space as was previously occupied by the old program and so over writing it.

Random access memory can only hold information whilst the power is switched on, turning your computer off will result in the complete loss of any program or data contained within it, prior to the power being removed.

The BBC also contains a certain amount of ROM or Read Only Memory, this memory contains the program or operating system that the BBC needs to communicate and interface with the outside world, it is normally known as firmware and unlike RAM cannot be overwritten or lost when the machine is turned off.

Other types of memory associated with micro and indeed mainframe computers are those known as media storage peripherals, disk drives, magnetic tape drives, punched tape and card machines, etc. These devices are normally used for long term data retension, the most popular now using magnetic media.

Data stored within a computer can be saved or down loaded on to a magnetic media device before the machine is turned off or another program is run. Data can also be up loaded in the form of a complete new program or simply more data for a continuing process, this kind of memory is known as virtual memory.

More Speed

Cassette recorders when used as media storage peripherals are generally very slow in the task of loading and saving computer software. Most micro owners will have used a cassette recorder as a storage device and will understand the tedious and time consuming process of searching an audio tape for a particular file. Now that you have a disk drive you will notice an incredible increase in filing speed. A disk drive can load or save a program several hundred times faster than a cassette recorder. There are many other advantages that the disk drive has over the cassette recorder that can only be appreciated by reading this book and experimenting with the drive.

Chapter 2

The 40 – 80 Track Theory

Before we begin to explain the floppy disk drive we must first take a look at the floppy disk and some of its terminology.

A floppy disk is a circular thin piece of magnetic media contained within a flexible cardboard or plastic jacket and when inserted into a disk drive rotates at precisely 300 RPM. With a stationary read head this would produce a single circular track around the disk, however the head inside a disk drive is able to move, either in towards the centre of the disk, or out away from the centre producing a number of tracks, typically 40 or 80. Since the total distance covered by the head is the same for both 40 and 80 track systems, the head inside the 80 track drive must step twice as many times to go the same distance as the head inside the 40 track drive. This distance is measured in Tracks Per Inch or TPI. A 40 track drive has a pitch of 48 TPI and an 80 track drive a pitch of 96 TPI.

Fig. 2.1. below, shows the basic out-line of a floppy disk, the points which we will now explain.

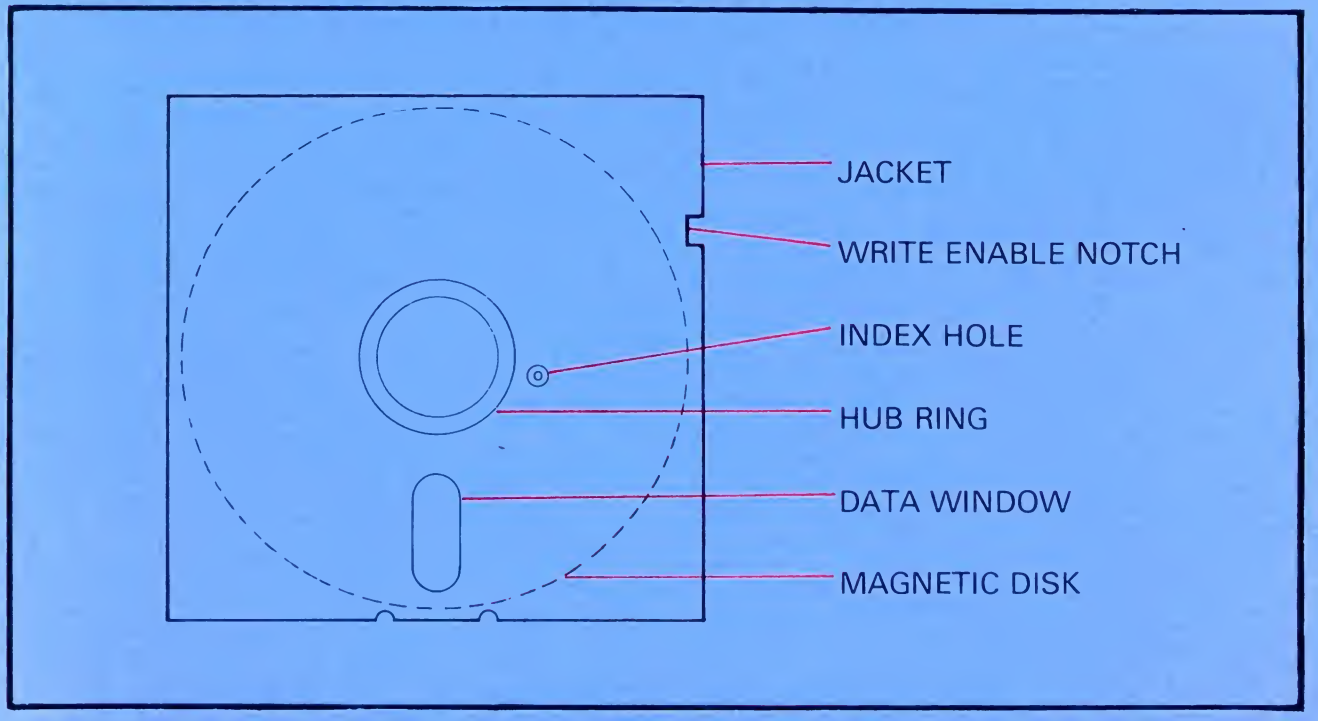


Fig. 2.1. A standard floppy disk.

Index Hole

This is a small hole in the jacket of the disk which when optically aligned with a further hole in the disk itself will produce a short pulse, this is referred to as the soft sector index and is used by the computer to time a single revolution of the disk.

Data Window

This is an elongated hole in the jacket which allows the read write head to make contact with the disk. The window appears on both sides of the disk as 40 or 80 track drives can have double heads for recording on both sides of a disk.

Write Enable Notch

This small notch on one side of the disk is used to enable the disk drives writing electronics, covering it with a small opaque write protect tab will prevent the disk drive from writing data to the disk. Useful for preventing accidental erasure of valuable programs and utilities.

Hub Ring

This exposed portion of disk is mechanically clamped between the disk drives clutch and drive hub, which spins as 300 RPM. The clutch engages as the disk drive door is closed.

Format and Density

Before a brand new diskette can be used by the computer it has to be formatted. This is a process which segments each of the tracks into a number of sectors. A sector is likened to a box which is capable of holding 256 bytes of information. The amount of sectors placed on a single track can vary. However, with the BBC mirco, 10 sectors are the limit. The BBC micro uses a formatting technique known as FM or frequency modulation better known as single density. A maximum of ten 256 byte sectors can be created on a single track using the single density FM format. Double density is another type of format that the Acorn DFS cannot produce, but for reference purposes only,

double density format uses modified frequency modulation or MFM. This has the effect of doubling the bit density on the disk and so allowing a twofold increase in the number of sectors per track. Double density should in no way be confused with the number of tracks. Technically it is the method used when formatting, either FM for single density or MFM for double density.

Capacity

By knowing the number of tracks on a disk and how many sectors per track there are we can calculate the storage capacity on each side of a disk and hence the total capacity of a disk e.g. In a single density there are 10 sectors per track with 256 bytes per sector a total track storage space of 2,560 bytes, with 40 individual tracks the storage area on one side of the disk would be 102,400 bytes and for an 80 track disk 204,800 bytes. If you have double sided drives the respective side capacity is doubled. For ease a disk drives capacity is quoted to the nearest 100 kilo bytes, e.g. A 40 track single sided drive stores 100K and 80 track single sided drive stores 200K and so on.

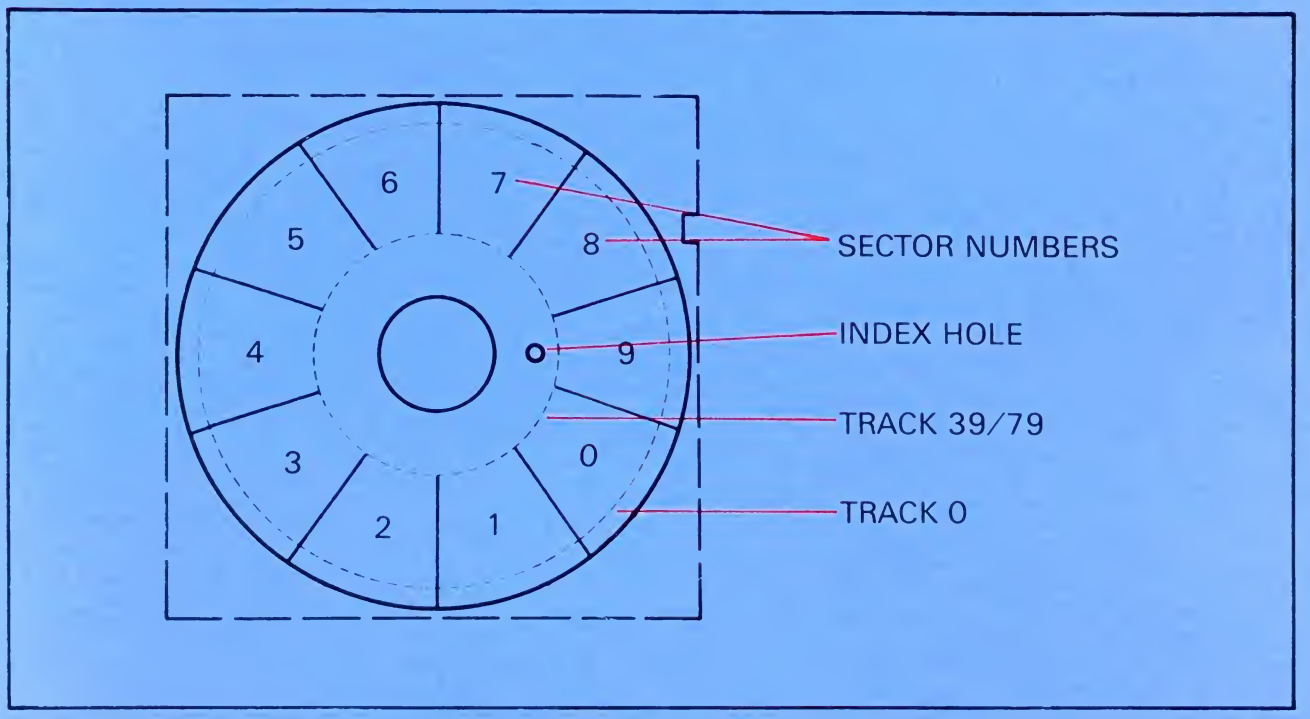


Fig. 2.2. Showing the 10 sector single density format (the sectors are laid out during the format process).

Catalogue

The catalogue of a disk is the area that contains all of the necessary information needed for the computer to locate and thus load any data contained on the disk, the catalogue also contains any name that you may give a file to aid easy recognition. The BBC's Disk Filing System uses the first two sectors, sector zero and sector one on the first track, track zero. Note: computers always count from zero and so sectors are numbered from zero upwards as are tracks.

When a file or program is saved to the disk, the disk filing system automatically makes a catalogue entry which contains the first track and sector number where the file can be found and also the length of the file in sectors and of course the file name that you used to save it.

Chapter 3

What Kind of Diskette

The diskettes to use in the CUMANA 5¼ inch drives are known as 5¼ inch mini floppy disks. However, there are two types of 5¼" disk, one of which can have some nasty effects when used with the BBC. Firstly there is the soft sectored disk which is now the norm among mini and micro computers, including Acorn's BBC, the other is the hard sectored disk. The essential difference to note between the two is the number of index holes that appear in the disk. Only one hole and the disk is soft sectored, basically the computer sees the hole in the disk and calculates one revolution, after this it sectors the disk up using a software formatting program. A hard sectored disk however has more than one hole and so a computer would use each hole as the start of a hardware sector, hence hard sectored. The BBC micro will not work if a hard sectored disk is used, it would attempt to time one revolution at each successive index hole and so give an error, typically it would think the disk was rotating several times faster than it should be.

Diskette Do's & Dont's

Most 5¼" disks are sold in packs of ten however, some vendors will sell disks in packs of one or two. Whichever way you buy your disks please observe the do's and don't diagrams found on either the disk sleave or carton. An example is shown overleaf in Fig. 3.1. Here are a few examples. Never leave a disk within a magnetic field such as loud speakers, mains transformers, electric motors, television sets, monitors etc. or anything you may suspect to be magnetic that could cause permanent loss or damage to your valuable files. As a point of interest, leaving the disk on top of a BBC micro is fatal, as hidden beneath the case is a large power supply and a small but efficient loud speaker. When a disk is not in use or in a drive, always replace it in its protective sleeve. An unprotected disk laying around can pick up small particles of dust that when re-inserted in a drive can cause expensive damaging results to the read write head, which in turn damages each successive disk used in the drive. Dust and grit will cause nasty scores across the disk removing the oxide coating, rendering the disk useless. Although disks are termed flexible, try not to bend the disks excessively, do try and keep them in a rigid plastic diskette box or library case. Do not touch any magnetic recording surface, dirt and grease will cause soft errors. Keep your disks at room temperature, excessive hot and cold spells will cause them to warp.

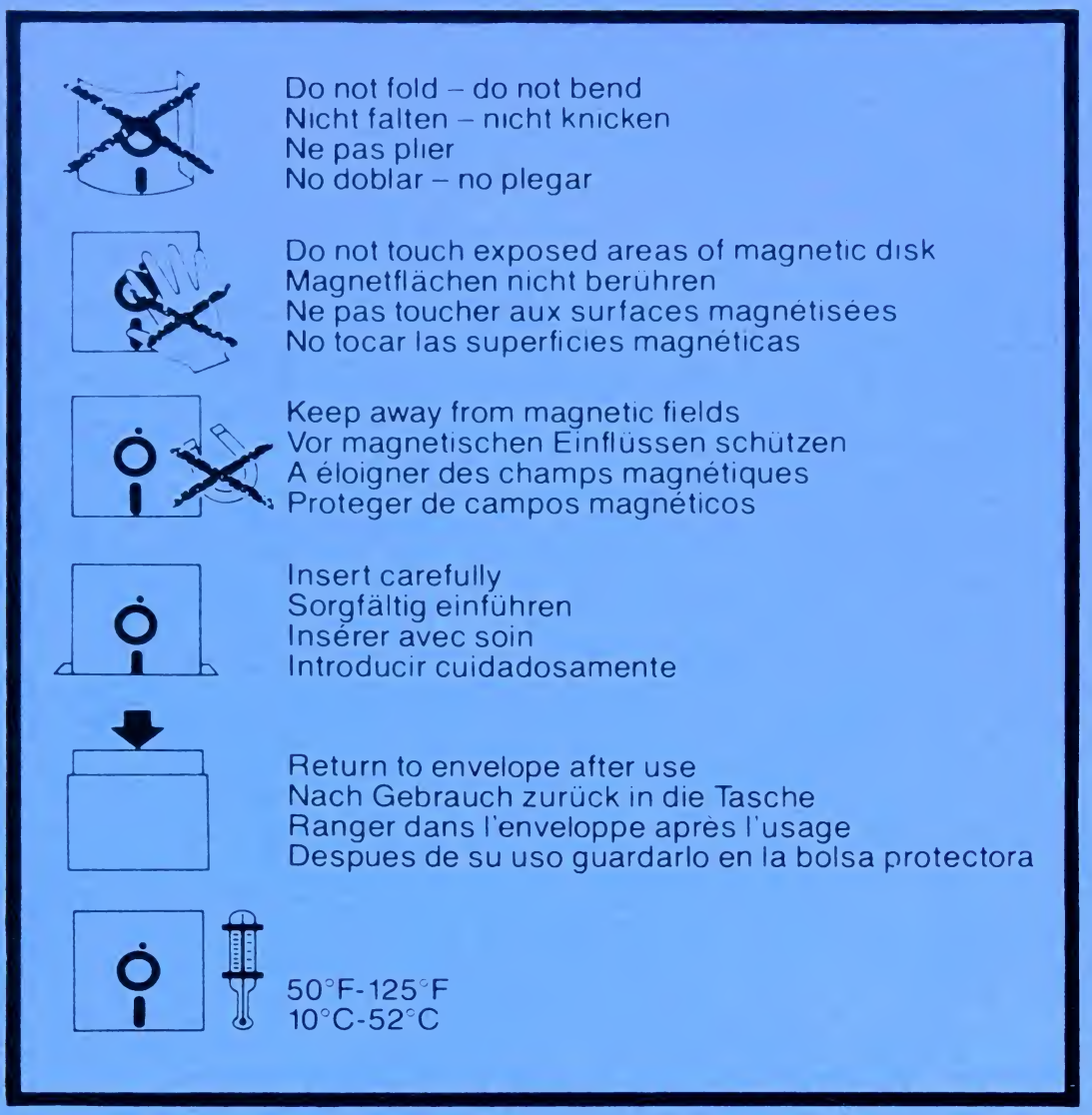


Fig. 3.1. Some disk sleeve warnings.

Chapter 4

Connecting Up

After you have carefully unpacked your brand new CUMANA disk drive, no doubt you will be quite eager to try it. Read on and you will find out how to connect it to the host BBC micro. First and foremost make sure all units are isolated from the mains power supply. Next position the disk drive in close proximity to the host micro, then locate the flat 34 way ribbon cable protruding from the rear of the disk drive. Whilst gently lifting the front of the BBC push it firmly in to the socket header marked '▲ disk drive'. The cable should only go in one way with the blue or red coloured stripe on the cable at the left or next to the indicator triangle in front of the 'd' in disk. In any case the cable should come down and away from the machine. See figure 4.1. for a clearer view. Do not attempt to force the cable socket into the header. It is possible to misalign the connector and so damage the header. If the socket refuses to go in check for possible bent pins in the header or incorrect orientation of the socket. Now that you have the drive interfaced with the micro the one thing we're short of is a power supply. The power required for your disk drive will come from either the internal power supply if you have one, or via a low voltage cable which must also connect to the micro. If you have the precision built power supply, simply attach the lead with moulded plug to your AC mains out-let and follow the power up sequence below. For those of you that have one of the CSX range of CUMANA drives you will need to connect the low voltage lead to the host micro as follows: Again, lift the front of the micro and locate the 'auxiliary power output' into this you must plug the low voltage lead which should also protrude from the rear of the drive and have on the end of it a square connector suitable for conection to the auxiliary output. This should only go in one way and without too much force.

See Fig. 4.1. overleaf

Power up Sequence

You should now have your system fully connected and ready for use, assuming you already know how to connect your TV or monitor, if not refer to the relevant section in your user guide. There is a method of powering on each of the devices which results in the computer being turned on last of all, reasons for this are varied, one such being the prevention of mains glitches reaching

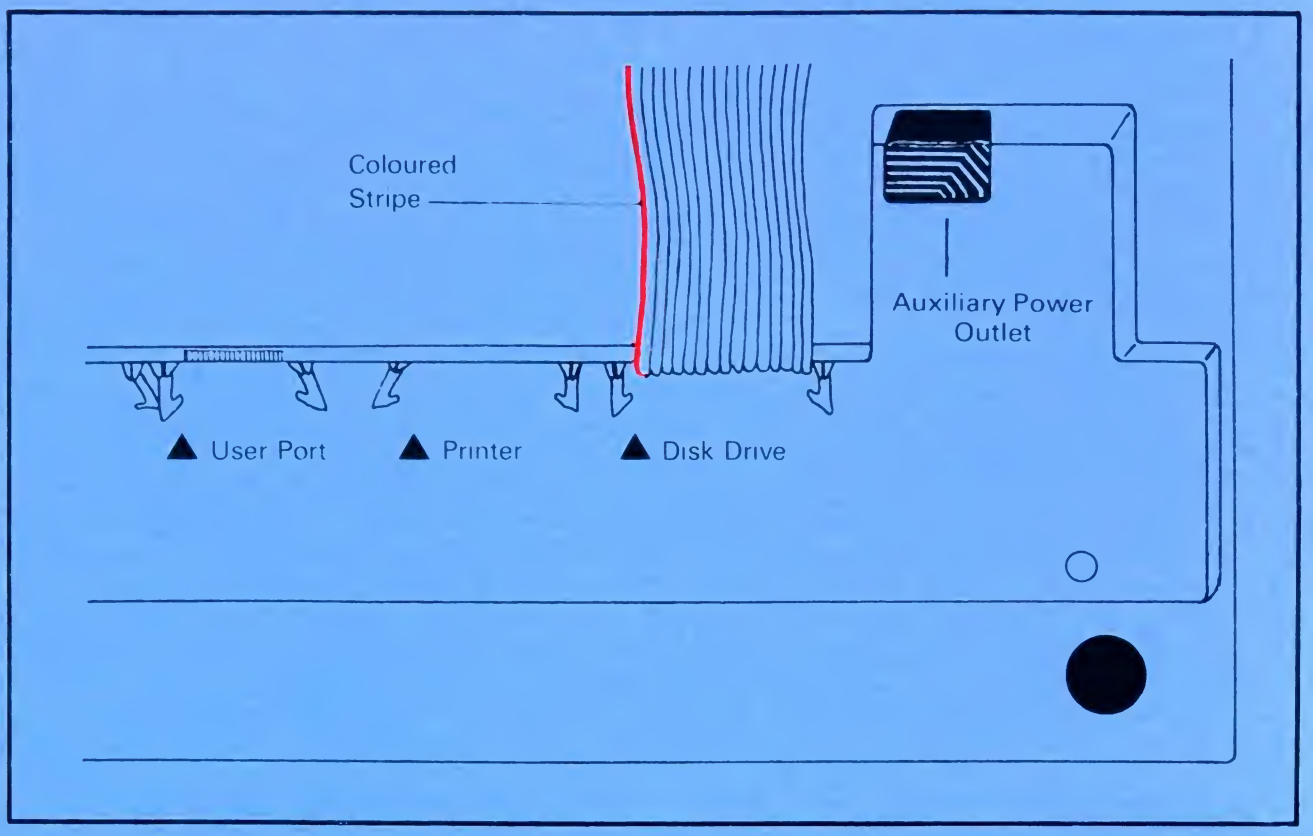


Fig. 4.1. The drive cable connection on the front underside

the micro after it has established its reset sequence. Start by turning on your display monitor or TV set, now your disk drive if it has built in power supply and finally the BBC micro. Some Cumana disk drives can be heard settling after being switched on others not, this is due to the read write head stepping motor adjusting to the correct phase. Your system should now be fully powered up.

The display on your monitor will vary according to the model of BBC and type of disk operating system used.

Most monitors and TV's have 'Switch Mode' power supplies which may cause interference on the heads of the disk drives. It is therefore advisable not to stand unscreened monitors, e.g. plastic cased, directly onto the top of disk drives.

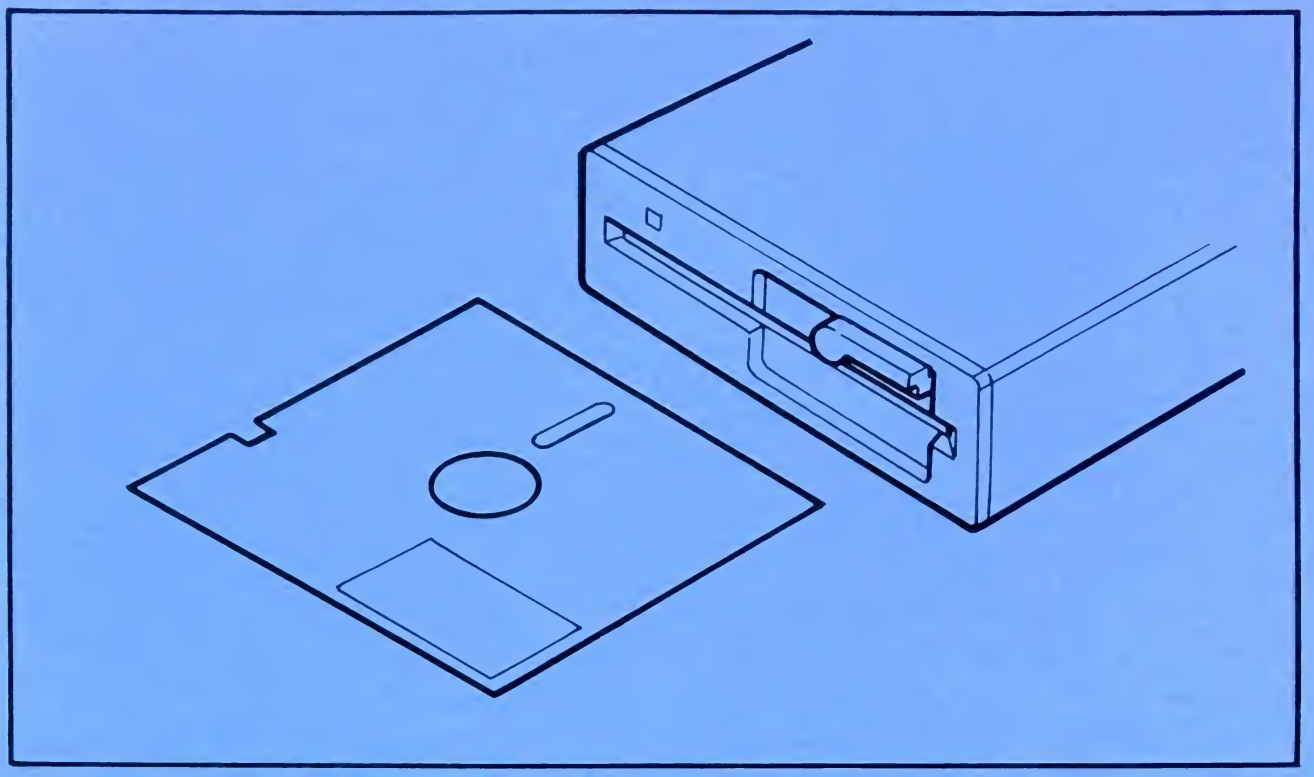


Fig. 4.2. Inserting a 5¼ inch Disk into the drive

The Door Mechanism

When inserting the disk make sure the title label is uppermost and the write protect notch/tab is on the left hand side. The data window should be forward and go into the drive first.

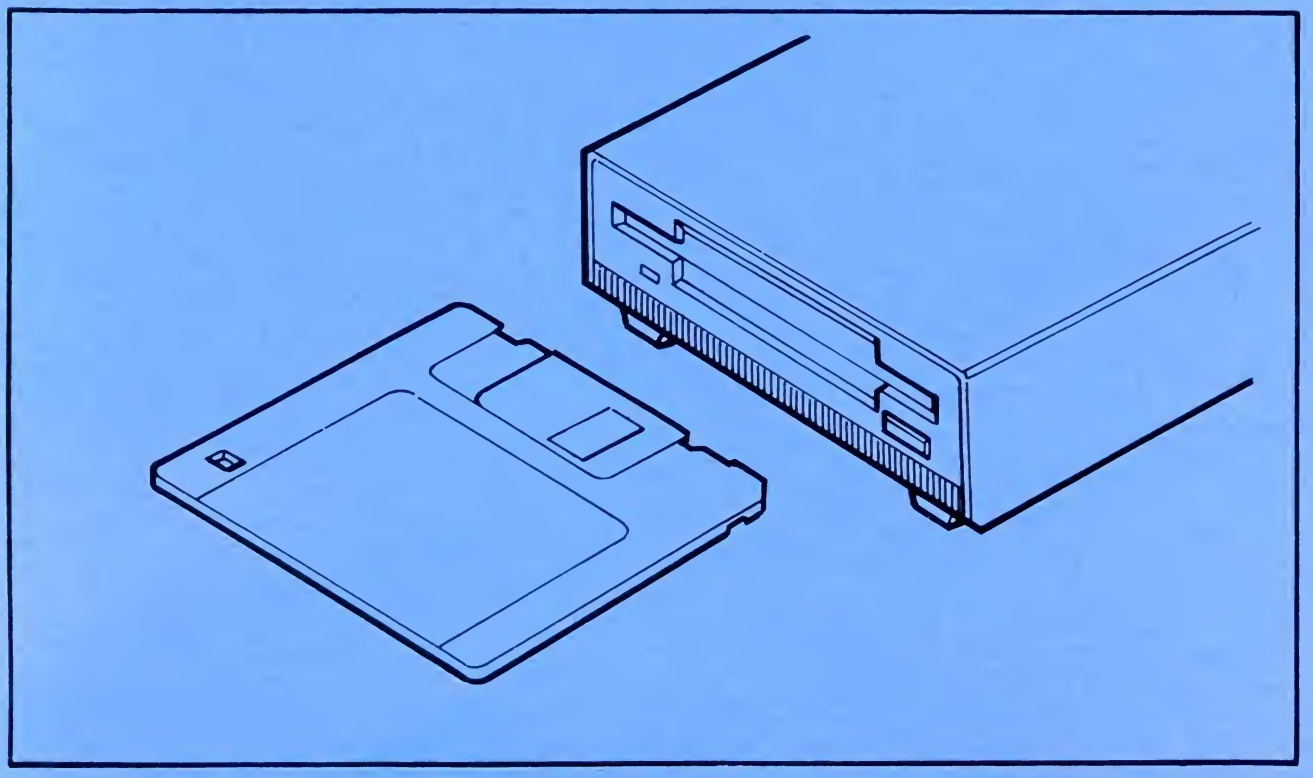


Fig. 4.3. Inserting a 3½ inch Disk into the drive

Chapter 5

Formatting BBC 'B'

Place the utility disk supplied in to the disk drive marked '0' and close the door.

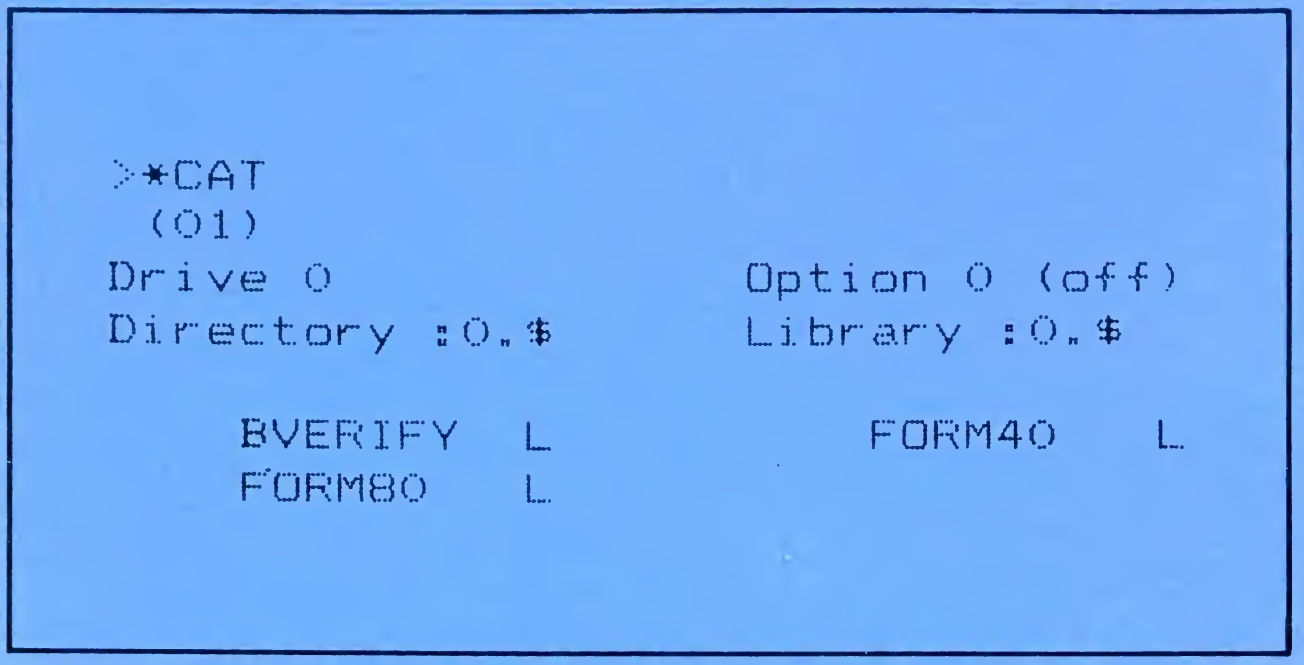


Fig. 5.1. Showing the catalog display

Once the disk has been inserted press the key <BREAK> on your keyboard, then type the command *CAT0 followed by a press of the RETURN key. Note the correct syntax and avoid putting spaces in the command line. The disk drive will start for a short period and the following should be displayed, as shown in Fig. 5.1.

As you can see, the computer goes to drive 0 and catalogs its contents. This is because the correct syntax for a catalog is *CAT <drv> where <drv> is the drive you wish to catalog, in the case of a dual drive system *CAT 1 could be applied and the result would be a catalog of the disk in drive 1. If <drv> is not specified then the default drive will be selected as drive 0.

You will notice in the catalog a file name 'FORM40' and if you have an 80 track drive you will see also the file name 'FORM80'. The format program is used to initialise blank disks typically those that have just been purchased. Because the format program is actually loaded into the machine's memory before it is used, it is recommended to save any existing file that may be of value at a later stage as the format program will over write part of the basic

storage area. Use the file 'FORM40' if you have 40 track drives, or the file 'FORM80' if you have 80 track drives.

Type the following line and follow it by a press of the <RETURN> key.

*RUN FORM40 (or) *RUN FORM80

The utility disk should be accessed following which the screen will go blank for a short period and then display the CUMANA name and the program issue number. In the centre of the screen will be a diagram representing a single segment of the disk. As you will see the diagram will be divided into either 40 or 80 columns representing tracks, being wider at the left indicating track zero and tapering toward the right indicating track 39 or track 79.

At the bottom of the screen will be a prompt asking

"IN WHICH DRIVE DO YOU WISH TO FORMAT?"

At this stage it is as well to remove the master utility disk from drive zero and insert a blank. Answer the prompt with a drive number normally 0 but if you have dual drives and you have inserted a blank in drive 1 by all means answer the prompt with 1 and press the RETURN key.

The blank disk will now be checked by the computer and if it is found to be blank the computer will proceed to format. If the computer finds the disk containing data then the message:-

"DISK ALREADY FORMATTED ARE YOU SURE?"

will be displayed. If this happens it is wise to double check the disk and make sure it is not a valuable piece of data or a precious game. If you are happy that the disk should be formatted then answer the prompt with Y or alternatively 'N' to cancel the format program.

If all is well the format should continue by filling each of the columns with colour as it formats the respective tracks. If the format is successful the column will be filled with green and the loud speaker will sound a short note. If the format is successful but the computer had to try more than once to format a track, the column will be filled with yellow and the musical note from the speaker will be mixed with white noise. This indicates a possible fault in the disk and the particular disk should not be trusted. If the format is completely unsuccessful the column will be filled with red, this indicates that the disk may well be badly damaged and should not be used at all.

If at the end the overall formatting of the disk is a success, the first two bars of

Beethoven's Fifth Symphony will be played. However, if the format fails two bars of the Funeral March are played and the message:-

"FATAL FORMATTING ERROR ON DISK"

is displayed.

At the end of a successful format, the option of repeating the formatting process will be given.

"FORMATTING COMPLETE"
"DO YOU WISH TO FORMAT ANOTHER DISK?"

Answer with either Y or N

When you have finished formatting press the break key to recover the memory used in high resolution graphics before continuing.

You may find after formatting several disks that the sound element of the format becomes frustrating. If this is the case then before entering the format program described above, type in the line *FX210,1 this will disable the loud speaker and render the machine quiet. To turn the sound on again type the line FX210,0 and the sound will be restored.

Chapter 6

Disk Formatting

(Acorn BBC B+ and Acorn BBC Master)

Format and verify on B+ and Master 128 – 1770 Mode

For standard BBC format on Master 128 perform CTRL Z BREAK. The 1770 DFS mode will be shown on the screen.

To then format on either the B+ or Master, type:

*FO. (number of tracks) (drive number)

Eg:

*FO. 80 0

The micro will ask

GO (Y/N)?

Type:

Y

The micro will then format the diskette

To verify, type:

*V. (drive number)

Eg:

*V. 0

The micro will then verify the diskette

The normal BBC format is 10 sectors, and regards two double sided drives, or one dual double sided drive as four drives. These are arranged as thus:-

Drive 0 { Top head drive 2 / Bottom head drive 0

Drive 1 { Top head drive 3 / Bottom head drive 1

Chapter 7

Making a Back Up

Now that you have several formatted disks, a copy of the utility disk should be made for archival purposes or just in case the master disk sustains a fatal injury.

The procedure for backing up is different for users of single drives or dual drives respectively. Firstly the single drive backup. Make sure the master utility disk has a write protect tab on it, a single drive backup can be easy to get wrong and may result in the master disk being written over.

Insert the master disk in drive '0' and type the line:-

*ENABLE followed by a press of the <RETURN> key.

Now type the line:-

*BACKUP 0 0 followed by a press of the <RETURN> key.

The computer will prompt you to alternatively insert and remove the two disks e.g.

'INSERT SOURCE DISK IN DRIVE 0 AND HIT A KEY'
'INSERT DESTINATION DISK IN DRIVE 0 AND HIT A KEY'

providing you press <BREAK> after you finished formatting the alternation between disks should occur no more than nine times for a 40 track disk, if you did not press 'BREAK' there will be insufficient free memory and so the process will take considerably longer.

For dual drive users things are much easier, simply place the master disk in drive '0' the slave in drive '1' and type the following line:-

*ENABLE followed by a press of the <RETURN> key
*BACKUP 0 1 and press the <RETURN> key

The computer will tell you that it is copying from drive 0 to drive 1, when it is complete remove the slave disk and label it appropriately, remember to write the label before sticking it onto the disk.

Double Sided Format and Backup

As mentioned previously, the BBC micro will only support two physical drives however up to four logical drives can be accessed by the use of double sided drives. To utilise the second side of a disk simply repeat the steps for formatting but change the drive number from 0 to 2 or from 1 to 3. The opposite side of the drive 0 is drive 2 and the opposite of drive 1 is drive 3. For backing up simply repeat the steps above, again inserting the drive numbers as required.

Chapter 8

BBC Master ADFS

When using the Master 128, the Cumana formatting diskette supplied with the disk drive is not required, however, if you have purchased a 3½ inch drive, a 3½ inch "Welcome" diskette will be required from your Acorn dealer.

When first powered up the screen may display:

Acorn MOS
BASIC

This is CASSETTE mode

Whilst depressing CTRL and A together, press the Break key, then release the Break key and release CTRL and A.

This is known as Control A Break

The screen should now display:

Acorn MOS
Acorn ADFS

This shows the micro is in ADFS mode.

Now try CTRL Z and break together.

The screen should display:

Acorn MOS
Acorn 1770 DFS
BASIC

The micro is now in DFS mode.

To return to the first screen, CTRL Q and Break, should be used.

Before proceeding further, it is worthwhile to configure the step rate of the computer's disk operating system.

The step rate is the time allowed for a drive to move from one track to another. This is measured in thousandths of a second which are called Milliseconds (ms).

Many old full height drives are still giving good service after six years (to date of writing), these units are TEAC FD 50's which require a 24 ms step rate. The 80 track units Cumana now use will step as quickly as 3 ms. 40 track drives, and 80

track drives set in 40 track mode, have to cover twice the distance, therefore twice the time is required, i.e. 6 ms. 80 track heads cover 96 tracks per inch whereas 40 track heads cover 48 tracks per inch in terms of distance of travel.

Some manufacturer's drives however, require more time to step than our latest units.

The Acorn BBC Master started life with a Western Digital 1770 disk controller chip. After some time, the W.D. 1772 chip was fitted, however, more recently manufactured Master 128's appear to be again featuring the 1770.

For further advice on step rates of your micro, contact your Acorn dealer, or Acorn's Technical Department direct.

All latest Cumana drives should run in both 40 or 80 track settings by typing:

*CO. FDRIVE1 <RETURN>

Followed by:

CTRL/BREAK

If using 40 track drive(s), place a Write Protect tab on the "Welcome" and Utilities diskette supplied with the Master, before going any further.

NOTE: The Write Protect sensors inside the drives are opto-electric devices, therefore only the foil type Write Protect tabs should be used as these are completely opaque and break the infra-red beam fully enabling Write Protect.

People with 80 track 3½ inch or 5¼ inch non-switchable drives should now move onto 80 Track instruction. (Page 25)

40 Track and 40/80 Switchable Drives

Switchable 40/80 track drive(s) should be set in the 40 track position, the reason for this will be explained later.

Insert "Welcome" diskette into drive 0, clamp lever, then type:

*ADFS <RETURN>

The 'drive in use' L.E.D. indicator should glow, and spindle motor revolve. After the micro has checked to make sure the diskette is the correct format, and a catalog is present, the > prompt will re-appear. Type

CH. "UTILITIES"

Press RETURN and the utilities menu will re-appear. Select choice no. 3 which is the ADFS utilities.

Type:

3 <RETURN>

The ADFS menu will now appear, Formatting program is Aform (1).

Type:

1 <RETURN>

The screen will display

Format which drive?

Those with dual drives should answer 1. If single drive only, answer 0

1 <RETURN> (dual drive)

0 <RETURN> (single drive)

Micro will ask:

Size of disc?

A 40 track single sided is "Small".

S <RETURN>

If dual drive is used, insert blank diskette into drive 1. If single drive, remove "Welcome" diskette and insert blank diskette.

Screen should display:

Formatting Drive 1 Small O.K.?
(or Drive 0 if single drive)

Type:

YES <RETURN>

The blank diskette will now be formatted and verified.

This is counted in hexadecimal (lots of 16)

40 tracks are therefore shown as hexadecimal 27, as below:-

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	16
10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, 1B, 1C, 1D, 1E, 1F	16
20, 21, 22, 23, 24, 25, 26, 27	8
	40

The screen will now revert back to

Format which drive?

Type:

Q <RETURN>

If using single drive, remove formatted diskette and insert "Welcome" diskette.

Press space bar.

Drive 0 will now reload the ADFS utilities menu.

The desired function now, is to backup the "Welcome" diskette onto the newly formatted diskette. Backup is displayed on the menu as option 3.

Type:

3 <RETURN>

Screen will show:

Input Source Drive

Type:

0 <RETURN>

Screen now shows

Input dest. drive

If dual drive is used,

Type:

1 <RETURN>

For single drive,

Type:

0 <RETURN>

The source disc, "Welcome", should still be in Drive 0 – press RETURN.

A dual drive will backup straight from Drive 0 to Drive 1.

Single drives however, are dependent upon using the memory in the computer to complete the Backup process. The computer will intake data via the drive from the source disk, put this into memory, and then ask for the destination disk to be inserted into the drive so that the data held in memory can be downloaded onto the formatted diskette.

The micro will then ask for the source disk to be re-instated into the drive, intake more data, ask for destination disk to download and so on, until the whole of the data has been transferred.

When finished the screen will display:-

Copy Complete.

Now place a Write Protect tab on the diskette you have just Backed-up.

40 track drive owners should store the original "Welcome" diskette in a safe place, to backup from again, if the diskette just written to is corrupted in any way.

40/80 switchable drive owners should keep this newly written diskette to refer back to when using 40 track mode, or for the occasion when 40 track drives may be run on your system.

80 Track and 40/80 Switchable Drives

Insert "Welcome" diskette into drive 0

Type

*ADFS <RETURN>

After a few seconds the > prompt will re-appear

Type

CH."Welcome80" <RETURN>

The Micro will ask –

Do you really want to convert the disc to double sided 80 track format (Y/N)

CAUTION: Some 40 track drives may have difficulty reading the diskette if it is ever converted back to 40 track use – however, if you still wish to proceed:

Type

Y <RETURN>

(Note: The Write Protect tab must NOT be fitted on the diskette at this stage or the drive will not be enabled to write to the diskette)

The drive will now start up and re-configure the diskette for 80 track operation.

The screen will show when this has been achieved, and will confirm that some 40 track drives may have trouble reading this diskette if it is ever converted back to 40 track use.

However, if you have followed the instructions for 40/80 track users, a 40 track back up version is now in your possession.

The computer will inform you at this stage that the 80 track mode uses the underside of the diskette. Single sided drives always use the underside of the diskette, only double sided drives utilise the topside.

Pressing the shift key will take you into the "Welcome" program, for safety's sake I would recommend CTRL A BREAK, remove "Welcome" diskette and affix a Write Protect tab.

Re-insert "Welcome" diskette into Drive 0, Type

*ADFS

And wait for the > prompt to re-appear

The diskette should now boot using shift/break, and display the utilities menu.

The desired utility is ADFS, type

3 <RETURN>

The ADFS utilities will now be displayed, the required option being AFORM.

Type

1 <RETURN>

The screen will display

Format which drive?

Those with dual drives should answer 1. If single drive only, answer 0

1 <RETURN>
0 <RETURN>

Micro will ask:

Size of disk?

An 80 track double sided is "Large"

L <RETURN>

If a dual drive is used, insert a blank diskette into drive 1. If a single drive is in use, remove "Welcome" diskette and insert a blank diskette.

The screen should now display:

Formatting Drive 1 large O.K.?
(or Drive 0 if single)

Type

YES <RETURN>

The blank diskette will now be formatted and verified.

The A.F.D.S. Totals both sides of an 80 track diskette as 160 tracks. (Hexadecimal count for 160 is 9F).

The screen will now revert back to:

Format which drive?

To quit this function:

Type:

Q <RETURN>

If using single drive, remove formatted diskette and insert "Welcome" diskette.

Drive 0 will now re-load the ADFS utilities menu, by pressing the space bar.

The desired function now is to copy the "Welcome" diskette onto the newly formatted diskette.

For this DIR copy must be used which is option 4.

Type:

4 <RETURN>

The monitor will display the following:

Source Drive?

Type

0 <RETURN>

Destination Drive?

Type

1 <RETURN> (or 0 <RETURN> for single drive)

Put source disc into drive 0

Press <RETURN> when ready

(Single drive owners must now follow displayed system prompts)

Put destination disc into Drive 1

Press <RETURN> when ready

Source root? $

<RETURN>

Destination root $

<RETURN>

Please input sub-directories not to be copied.

?

<RETURN>

Begin at which entry?

<RETURN>

The Micro will now start to copy the diskette

Single drive owners will have to follow the prompts to change source diskette and vice versa until copy is complete. The boon of a Cumana dual drive will at this time become apparent, as even with a dual drive this program takes in the region of 15 minutes, to complete without having to re-insert diskettes.

After "COPY COMPLETE" has appeared on the monitor, the copy just created should be placed in drive 0, and the boot option command should be written to the diskette by carrying out CTRL A BREAK and typing.

*OPT4,3 <RETURN>

Now place a Write Protect tab on the diskette you have just created. It is now possible to backup the copy made from the original "Welcome" diskette, onto a formatted diskette. (Faster than using the COPY facility).

Chapter 9

File Specifications

Programs or files (as they will from now on be referred to) are normally given names to identify them. This name or filespec abbreviated to <fsp> can consist of numbers and letters to a maximum of seven in total. There are however some characters reserved for special purposes namely (:.#*!) and these should not be included as part of the filespec. When a file is saved to disk it is given a name. This name is recorded in the catalog along with other vital information some of which is visible when the catalog is displayed and some which is not. Consider the command SAVE":0.$.TEST" note the use of ":" & "." as part of the filespec. I will now break down the <fsp> and describe each of the components.

Firstly :0. this tells the computer which drive is to be used
$. this specifies the directory (more on this shortly)
Test this is the actual file name

In practice, however the <fsp> can be shortened thus:- LOAD"TEST". Note a drive has not been specified nor has a directory. This is because both these items default to predetermined values at power on. The defaults are drive '0' and directory "$". As you can see the syntax is now the same as for cassette operation and is known as the alternative filespec <afsp>.

Within a catalog, files can be placed in various directories. This allows you to use the same file name providing each one is in a different directory. In the above command the directory was "$" this is the default directory assumed by the computer at power on. To change the directory the following command is used:-

DIR <dir>. Any alphabetical character can be used but reserved characters (:.!) should again be avoided. To change the default drive number, the command:-

*DRIVE <drv>. is used where <drv> is any number between 0 & 3 inclusive.

Wildcards

By using wildcards you can process a group of files with similar filespecs to achieve a common end. Two of the special characters # & * are used. The

symbol '#' is used to replace a single character and the symbol '*' is used to replace a group of characters e.g., The command *INFO <afsp> will give information about a given file in the catalog. *INFO FORM#0 will give information about both files FORM40 and FORM80. *INFO B##T would give information on files BELT, BEST, BENT etc. Another example might be *INFO *.B* or if all files are required, *INFO *.*

Chapter 10

DFS Keywords and Utilities

Keywords such as those used in the previous chapter are reserved for the DFS only, they all begin with the character '*'.

*ACCESS <afsp> L

The command Access will lock or unlock a file. Locking a file will prevent it from being accidentally over written. To lock a file use:-

*ACCESS <afsp> L

To unlock a file use

*ACCESS <afsp> Omitting the 'L'.

To lock all files use the wildcard facility *ACCESS *.* L.

*BACKUP <src drv><dest drv>

Backup is a utility that allows a copy to be generated of a master disk from and to any drive. As the destination disk will be totally overwritten, it is advisable to ensure that you no longer require any of the previous data.

*BUILD <fsp>

Will build a set of commands into a file that can be directly executed by the command *EXEC <fsp>.

As each line is typed it will be given a line number and on completion, pressing ESCAPE will save the file to the current selected drive. The command can also be used to create the auto boot file '!BOOT' this is a special name that is reserved for the auto boot function. Pressing the SHIFT key and holding it whilst pressing the BREAK key will automatically execute the !BOOT file. See *OPT for more details. Useful boot files are those that do repetitive tasks e.g., a boot file that executes a menu program that assists in easily selecting the

program you require, or a boot file that sets the function keys for tasks such as word-processing.

*CAT <drv>

CAT will produce on the screen a catalog of files that are on the disk. It will also show the current directory, the disk title, whether the file is locked or not, and what the current library is. The <drv> is optional or can be in the range 0 to 3.

*COMPACT <drv>

Compact has the effect of moving all the files contained on the disk down to one end and so compacting any free space created by the deletion of previous files. As each file is moved information about the file is displayed on the screen. e.g. $.TEST FF1900 FF801F0001FF004. See *INFO for more details.

This command need only be used if files are deleted from the disk.

*COPY <src drv><dest drv><afsp>

The copy command copies a named file from any drive to any drive. The wildcard is useful here e.g.,

*COPY 0 1 *.*

Will copy all the files from drive Zero to drive One. Note also that the copy command uses memory normally associated with resident programs, you must therefore save any file in the machine before using copy.

*DELETE <fsp>

The delete command will remove a single file from the directory of the disk, and once removed cannot be restored.

DELETE (Y/N)?

Type Y to delete the files or any other key to cancel the command.

*DESTROY <afsp>

The destroy command is used with the wildcard facility to delete a group of files. The command can have devastating results and so the *ENABLE command must precede. After the command is entered the computer will list all files that may be destroyed and ask you to confirm the operation e.g.,

```
*ENABLE
*DESTROY *.F*

$.FILE1
$.FILE3
$.FIRST
```

*DIR <dir>

The <dir> can be any alphabetical letter, and after the command is used any file saved will be placed in the selected directory, unless the full filespec is used. After pressing the BREAK key or powering on, the directory will be the default '$'.

*DRIVE <drv>

This command is used to change the default drive. It can be any number in the range 0 to 3 inclusive. After BREAK or at power on the drive default is set at 0.

*DUMP <fsp>

This command will display a hexadecimal listing of the file with ASCII equivalent characters on the right hand side of the screen. It can be used in the paged mode, and is normally required for examination of machine code programs.

*ENABLE

The enable command is used in conjunction with other commands that have a destructive nature. The enable command precedes the destructive command.

*EXEC <fsp>

Using *EXEC will execute a file that was created with the *BUILD command. It will appear as if you were typing the lines on the keyboard and is particularly useful for doing repetitive tasks, one such task would be defining the user function keys.

*HELP <keys>

The help command is used to gain information about the computer and the various ROM software that can be fitted. One such ROM is the DFS. Typing *HELP on its own will list the ROM's installed in the computer. Typing *HELP DFS will display the correct syntax for all the Disk Filing System commands, that is, the commands that reside within the DFS ROM, e.g.,

DFS 0.90

ACCESS <afsp>(L)
BACKUP <src drv><dst drv>
COMPACT <drv>
DELETE <fsp>
DESTROY <afsp>
DIR <dir>
DRIVE <drv>
ENABLE
INFO <afsp>
LIB :<drv> <dir>
RENAME <old fsp><new fsp>
TITLE <title>
WIPE <afsp>

OS 1.20

Typing *HELP UTILS will produce a list of the general utilities that are available within the DFS e.g.,

*HELP UTILS

DFS 0.90
  BUILD <fsp>
  DISC
  DUMP <fsp>
  LIST <fsp>
  TYPE <fsp>
OS 1,20

*INFO <afsp> (L) <start><exec><length><sa>

INFO will display information about any file on the disk. Where 'start' is the starting address of the file, 'exec' is the execution address, 'length' the length of the file in bytes, and 'sa' the sector address or starting sector for the file. A similar report is given when using the *COMPACT command.

*LIB :<drv> <dir>

The LIB command is used to set the library drive and directory. Typing *LIB:1.C will set the drive to '1' and the directory to 'C'. After <BREAK> is pressed the library is reset, the drive becomes '0' the directory '$'. These are the default values.

The correct use of the LIB command is to redirect machine operating system calls to the selected library drive and directory. e.g:-

Typing *TEST or *RUNTEST <RETURN>. Will first search the MOS ROM, if the command is not found it is then offered to the sideways roms starting from the right hand side, if it is still not found the current drive and directory is accessed and searched, then the current library drive and directory is searched, in this case drive '1' directory 'C'. If the command is not found an error message 'Bad command' will result.

This command is particularly useful for users with dual drives where a utility disk can be kept in drive 1 and the LIB command set to drive 1 this would leave the disk in drive 0 free for normal use. *RUN commands if not found on drive 0 would automatically go to drive 1.

*LIST <fsp>

The list command will display a file as lines of ASCII text. Each line of text will be given a line number. The command is useful for displaying files created using *BUILD or *SPOOL. However, it is not intended to list out programs created by the basic language within the machine. When BASIC is written it is stored in compressed or tokenised form and when displayed under *LIST appears as rubbish. However, basic programs can be converted into ASCII text see *SPOOL.

*LOAD <fsp><address>

Will load a file into memory, the starting address will be supplied by the command line, or if omitted the default load address is used from disk.

Example:-

*LOAD M.CODE 2000 will load the file M.CODE into memory starting at address location &2000 (HEX)

*OPT N n

There are two *OPT commands that concern the use of disk drives they are:-

*OPT 1 n

When a file is accessed from the disk, normally nothing is displayed about the file. However, using '*OPT 1 1' will enable the file specification to be displayed on the screen. '*OPT 1 0' will disable the information from being displayed.

*OPT 4 n

Where (n) is a value in the range 0 to 3. The OPT 4 n command is displayed in the catalog just above the library and to the right of the screen (see Fig. 5.1., page 13). The OPT 4 n command is concerned with the auto boot function of the computer and changing the option can have varying effects e.g.

*OPT 4 0 will do nothing if the auto boot function is OFF.

*OPT 4 1 will automatically *LOAD the file !BOOT. If the file is not on the disk an error message will be produced.

*OPT 4 2 will automatically *RUN the file !BOOT. Again if the file is not found an error will result.

*OPT 4 3 will automatically *EXEC the !BOOT file.

When setting the option the *OPT 4 n, values are stored on the disk and so a write protected disk will generate the error "WRITE PROTECTED"

*RENAME <old fsp><new fsp>

This command is used to rename a file, but can also be used to transfer files from one directory to another. e.g.:-

*RENAME A.MYCODE B.MYCODE. This has transferred the file MYCODE from the A. directory to the B. directory.

*RUN <fsp>

Will load a machine coded program at the saved address and begin execution at the saved execution address.

*SAVE <fsp><start><end><exec><reload>

Will save a portion of memory typically machine code, where <start> is the 4 digit HEX location of the start address, <end> is the 4 digit HEX location of the end address, <exec> is the 4 digit HEX location of the execution address, and <reload> is the 4 digit relocation address. Both the execution address and the relocation address can be omitted in which case they are assumed to by the same as the start address. e.g.,:-

*SAVE PROG 2000 2800 2100 1900

This will save the position of memory between &2000 and &2800 (continued under another file). The address at which execution begins is &2100 and if the file is called up again it will load at address &1900, unless otherwise instructed.

There is an alternative syntax for *SAVE e.g.,

*SAVE <fsp><start>+<length><exec><reload>

Where length is a 4 digit hexadecimal value which must be preceeded by the + sign. Again, the execution and relocation addresses are optional. e.g.

*SAVE PROG 2000+0800

Will save a portion of memory from address &2000 to address &2800.

*SPOOL <fsp>

This command will open a file <fsp> and then any ASCII text that is sent to the screen will be spooled into the open file. To close the file simply type *SPOOL again.

This utility is particularly useful for creating text files from basic programs. Once created they can be listed with the *LIST or *TYPE commands. Another powerful feature of the spool command is the ability to merge two basic programs together e.g.:-

Suppose there are two basic programs stored on disk, one called "FIRST" the other called "SECOND" and we wish to merge them both into "ONE" program. The program "FIRST" will need to have lower line numbers than that of "SECOND" (the basic renumber facility can be used here). The procedure is as follows:-

```
LOAD "FIRST"
*SPOOL LISTING     (opens the file LISTING)
LIST               (lists the file FIRST)
*SPOOL             (closes the file LISTING)
```

We now have a spooled file, LISTING. To merge two files as follows:-

```
LOAD "SECOND"      (load the second file)
*EXEC LISTING      (Executes LISTING as fast keyboard entry)
```

We must now save the merged basic programs as one e.g.,

SAVE "ONE"

The file "ONE" is now both FIRST and SECOND merged.

Note: When closing the spooled file, *SPOOL must be typed without a file name.

*TITLE <disk name>

Title is a command used to give your diskette a useful name. The name can be up to twelve characters long but must not contain any spaces. If spaces are required the whole title must be placed in quotes e.g.,

*TITLE "GAMES DISK". Alternatively, the space can be made be pressing the SHIFT and a function key together. This relieves the need for quotes and can have some colourful results in MODE 7.

*TYPE <fsp>

This command is very similar to the *LIST command except that it does not provide line numbers when used.

*WIPE <afsp>

This command has a similar effect to *DESTROY but does not require the enable command. It will instead list the files to be erased one by one, asking each time for confirmation answer with either (Y/N).

Abbreviations for DFS Commands

*ACCESS	Abbr	*A.
*BACKUP	Abbr	*BAC.
*BUILD	Abbr	*BU.
*CAT	Abbr	*.
*COMPACT	Abbr	*COM.
*COPY	Abbr	*COP.
*DELETE	Abbr	*DE.
*DESTROY	Abbr	*DES.
*DIR	Abbr	*DI.
*DRIVE	Abbr	*DR.
*DUMP	Abbr	*DU.
*ENABLE	Abbr	*EN.
*EXEC	Abbr	*E.
*HELP	Abbr	*H.
*INFO	Abbr	*I.
*LIB	Abbr	*LIB
*LIST	Abbr	*LIST
*LOAD	Abbr	*L.
*OPT	Abbr	*O.
*RENAME	Abbr	*RE.
*RUN	Abbr	*R.
*SAVE	Abbr	*S.
*SPOOL	Abbr	*SP.
*TITLE	Abbr	*TI.
*TYPE	Abbr	*TY.
*WIPE	Abbr	*W.

Any of the abbreviations noted above can be used in place of the full syntax e.g..

```
*EN.
*BAC. 0 1
```

Chapter 11

Random Access Files

This is where disk drives and the disk filing system really come into their own. There is of course a drastic speed increase over the cassette counter part. However, with disk drives you have the ability to position the read write head at any point on the disk that you choose and read or write just one small piece of information. With cassettes, one has to read the whole file, alter it, save it back, or alternatively sequentially read it until the piece of information required is found. All of this can take quite some time especially if the file is large.

There are certain basic key words that aid the manipulation of text files they are:-

BGET=	(gets one byte from the buffer)
BPUT=	(puts one byte into the buffer)
EOF=	(used for detecting the end of file)
EXT=	(indicates the lenght of file)
INPUT=	(inputs a block of data from the buffer)
OPENIN=	(opens a file for data input)
OPENOUT=	(opens a file for data output)
PRINT=	(outputs a block of data to the buffer)
PTR#	(points to the current file position)

When using text files the computer sets aside an area of memory called a buffer. This buffer contains 256 bytes and interfaces the user data with the disk's sectors. A disk sector happens to contain 256 bytes, so it can be seen that a buffer full of information will be sent to the disk and in so doing will free the buffer for more information.

Beside the keywords above is an explanation of how each command acts on the text buffer. The reader should refer to the BBC user guide for a more detailed explanation of the basic keywords.

When a file is read the buffer is filled with one sectors worth of information (256 bytes). As it is emptied by the user program so it is filled again until the end of the file is reached. The same can be said when writing to a file as the buffer is filled so it is written to the disk freeing the buffer for more information.

A buffer is opened or rather a file is opened for output by using the keyword: OPENOUT# e.g.,

A=OPENOUT "MYFILE".

NOTE: When a file is opened from new, 64 disk sectors are reserved for the file. This is quite a lot of space and often the error message 'DISK FULL' will result. On closing a file only the space used for data is taken from the disk. If you only use say 3 sectors from the 64 allocated the other 61 will be left free after you close the file.

An example program:

The following program shows how we can store a list of names on the disk.

Example (a)

```
10 A = OPENOUT "MYFILE"
20 PRINT# A, "PLUM"
30 PRINT# A, "CHERRY"
40 PRINT# A, "APPLE"
50 PRINT# A, "ORANGES"
60 CLOSE# A
```

The keyword OPENOUT, in this case, opens a file called 'MYFILE'. The 'A' is the channel variable allocated to the file. A maximum of five files can be opened at any one time.

The 'PRINT# A' outputs the name string to channel A. The 'CLOSE# A' stores the incomplete buffer onto the disk and in so doing closes the previously opened file.

If the file 'MYFILE' already exists on the disk it will be deleted and the file name 'MYFILE' re-entered in the disk catalogue under the currently selected directory.

The following program can be used to read in the data created in the above program.

Example (b)

```
10 A = OPENIN "MYFILE"
20 REPEAT
30 INPUT#A.NAME$
40 PRINT NAME$
50 UNTIL EOF#A
60 CLOSE#A
```

The diagram below shows how the data used in the above programs is actually stored on disk. Note: the addition of the two bytes T & L. These bytes tell the computer what type of data to expect 'T', and how long it is 'L'.

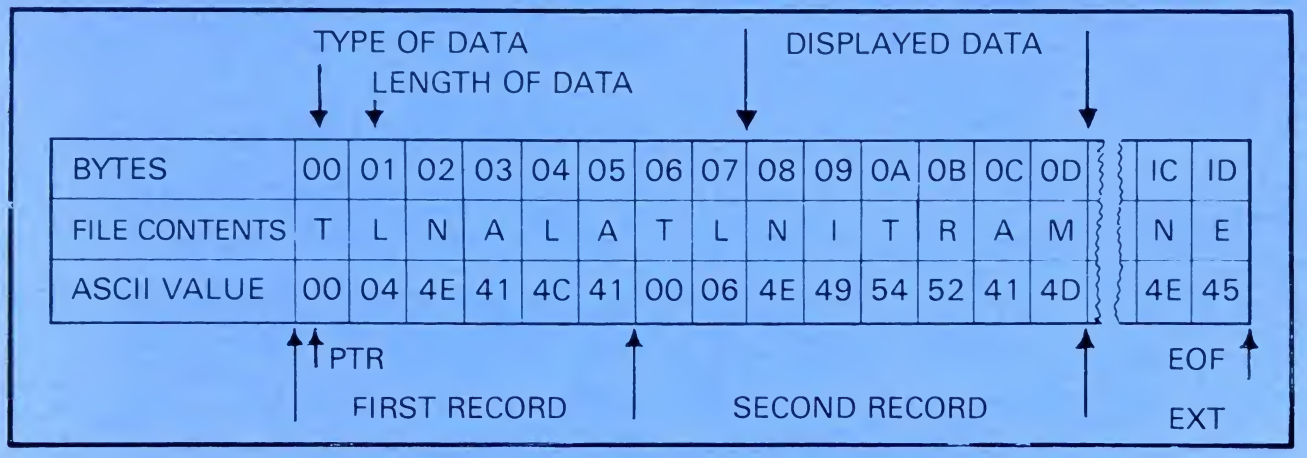


Fig. 11.1. Showing data storage on a disk.

When T = 00 the data following is string type.
When T = 40 the data following is integer type.
When T = FF the data following is real type.

Using the Pointer

Using the pointer PTR# we can move to any record in our file and access it directly without having to read all the records. However, to do this we must know the length of each individual record to be able to position the pointer precisely. If the above programs were much larger the problem of knowing the lengths would become apparent. If however, we keep the length of the records a standard size by padding out with spaces the position of a particular record can be easily calculated. Consider the following program:-

Example (c)

```
10 A = OPENOUT "DUMMY"
20 FOR X = 1 TO 100
30 PRINT#A,"DUMMY SPACES"
40 NEXT X
50 CLOSE#A
```

This program creates 100 records each with a length of 12 bytes, by knowing this and by knowing that each record is preceded by 2 bytes T & L we can position the pointer with ease to the record of our choice.

The following program uses the pointer to directly access record 49.

```
10 A = OPENIN "DUMMY"
20 PTR#A = 49 * 14
30 INPUT#A, TEST$
40 PRINT TEST$
50 CLOSE#A
```

A complete book could be written on the subject of Random Access Files alone. The examples above have been included to supplement the information contained within the BBC user guide. References to the BBC user guide should be made whilst reading this chapter.

Chapter 12

Transfer from Tape to Disk

The BBC micro with a disk filing system fitted uses memory normally available to the Tape version. This memory is between Hex &E00 and &1900. PAGE in the disk version is therefore set at Hex &1900. Whilst there should be no problem loading cassette files at &1900 there may be a problem running them, especially if the file is quite large and uses one of the hi-resolution graphic modes. If you wish to use such a cassette file from disk you will need to transfer it. The way to do this is simple.

For BASIC programs do the following:-

Type *TAPE <RETURN> Then
LOAD "NAME" <RETURN> Where "NAME" is the name of the file. Remember disk file names can only contain a maximum of seven characters and so some cassette file names will have to be shortened.

Now type:-

*DISK or *DISC <RETURN> Either spelling is accepted.
SAVE "NAME" <RETURN>

The file should now be present on disk. If the file is one that will not run directly from disk it will have to be moved down in memory to its normal place Hex &E00.

To do this define a function key as follows:-

*KEY0 FOR A%=PAGE TO TOP STEP 4:!(A%-2816)=!A%:NEXT:
PAGE=&E00¦M OLD¦M *TAPE¦M RUN¦M

Now load the file from disk and press function key 0. This will automatically relocate your program at Hex &E00 and begin execution.

When transferring machine code files to disk certain additional information is required. The following operations show how to operate them.

First type:-

*TAPE <RETURN>

Then:-

*OPT 1 2 <RETURN> This will give information about the file after it has loaded.

E.g.:-

*LOAD NAME 2000 <RETURN> Note: The file is force loaded at HEX &2000 and the screen should display:

NAME 04 0500 00000E00 00000E3C

Where "NAME" is the file name 04 is the number of blocks, 0500 is the length in bytes (Hex), 00000E00 is the loading address (Hex) and '00000E3C' is the execution address (Hex).

From the information given above we can now save our file to the disk drive. Firstly write on a piece of paper the length of the file, the load address and the exec address for future reference. Now Type:-

*DISK <RETURN>
*SAVE "NAME" 2000+(length) <RETURN>

Where 'NAME' is the file name required (up to seven characters) and (length) is the length of the file given above. In this case '0500'. Remember the file was loaded at &2000 so we must save it back from that address.

There should now be a copy of the file saved on disk. To use this file at any time you will have to load the file using *LOAD "NAME" <RETURN>.

Once you have loaded this, you will have to move it down in memory to its original operating address. Again we can use a function key to do this, but this time the variables required are written on your piece of paper. Type the following:-

*KEY 1 FORA%=&2000 to (&2000+length) STEP 4:!(A%-VAR)=!A%:
NEXT:M

Where "length" is the length of the file (Hex) in this case &500 and VAR is a variable calculated by subtracting the original load address (&E00) Hex, from the force load address (&2000) Hex. The sum in this case would be &1200 Hex. Leading zero's in Hex notation can always be removed.

Pressing function key 1 will now shift your machine code file down to the

original load address. The file is now ready to use. If the file can be executed, simply call the execution address written on your piece of paper. In this case:-

CALL &E3C <RETURN>

Chapter 13

Switchable Disk Drives

The switchable disk drive is a machine that is capable of reading disks created on either a 40 Track drive or an 80 Track drive. This drive is in essence an 80 track disk drive with some clever electronics incorporated that allow the user to chose the track pitch he desires. This choice is made by the setting of a switch easily found on the unit. In Chapter Two I mentioned the different track pitches for 40 and 80 track systems, the 40 track drive has a pitch of 48 TPI and the 80 track drive a pitch of 96 TPI.

When the computer sends a step pulse the drive head moves one track, either in towards the centre of the disk or out away from the centre. It would normally take 80 step pulses to move the drive head across the complete range of tracks. However, when the drive is set in the 40 track mode the electronic device adds a second pulse to every one received from the computer. The computer only needs to issue 40 pulses to move the head all the way across the disk. This does however present a small problem. The width of the head in an 80 track drive is smaller than the head in a 40 track drive, so when the switchable drive reads a track created on a 40 track machine it only reads half the full track width. This it does with ease, the problem occurs when you attempt to write to a disk in the 40 track mode since the head width is smaller, data is only written to half of the correct track width.

The switchable drive will read this data back without fail. However, if the disk were to be placed in a real 40 track drive the drive would attempt to read half the old data plus half the new data. Ultimately this ends with an error message typically DISK FAULT 18 AT XX/YY which means data not found at the indicated track and sector. See Fig. 13.1. overleaf, for a clearer understanding. The only suggestion I can make for users wishing to write 40 tracks on such a drive is this.

(a) The disk used is brand new or a previously used disk that has been bulk erased.
(b) The disk is formatted on a switchable drive set in the 40 track mode.

If these simple steps are adhered to there should be no problem. Remember, as soon as the disk is written to in a 40 track drive the width of the track will be increased and so rewriting again with a switchable drive can cause a problem.

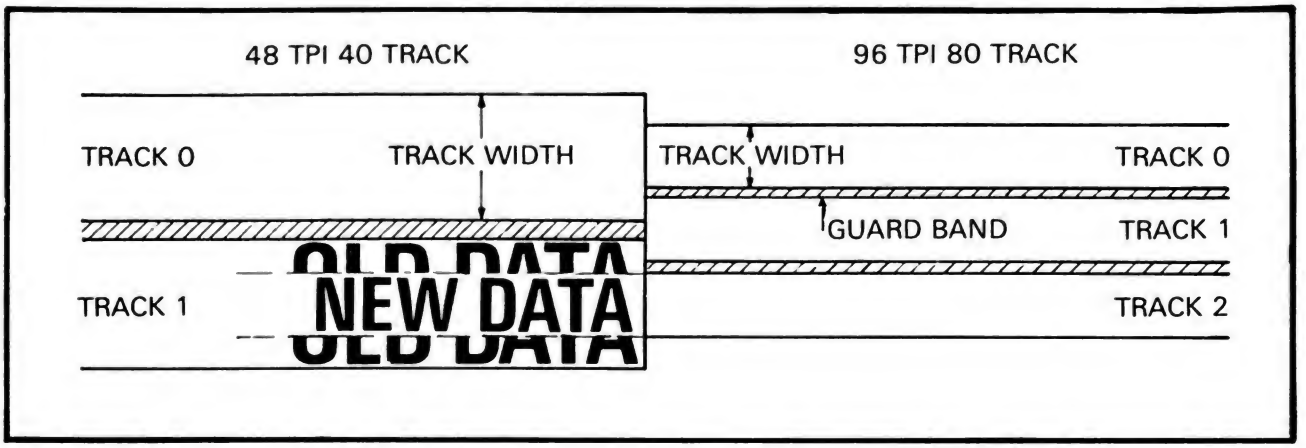


Fig. 13.1. Showing the overlap from 40 track to 80 track drive.

The golden rule is this:-

When exchanging disks with friends or colleagues remind them to make a BACKUP copy, then any modifications they make can be made on the copied disk without the fear of read write errors. If you abide by the same principle then the rule will work both ways.

NOTE: If a disk becomes corrupt, copy the files that are readable and then reformat the disk. If you always keep a backup you will be one step ahead of an accident.

As you can see, in the diagram above, if an 80 track head writes to an original 40 track disk, 'Old Data' is written over by 'New Data' in half the track width, leaving data that will be read by a switchable drive but not by the original 40 track machine.

Chapter 14

3½ Inch Disk Drives

One of the obvious differences between 3½ inch drives and 5¼ inch drives is the size of the drive and the different disks used. The diskette for instance is rigid or rather the flexible disk is encased in a rigid plastic jacket. The advantage is that it cannot be bent severely and become damaged. Also, the data window is protected whilst not in use and thus prevents fingers, dust and grit from damaging the delicate surface. The write protect notch is still optically sensed but instead of using countless sticky tabs to enable and disable the write option the 3½ inch disk has a small plastic switch that covers or uncovers the protection indicator. This disk is no longer clamped between a hub and a clutch. Instead it has a metal disk stuck to the media that engages directly with the drive motor. The drive is more advanced technologically allowing even smaller read write heads with larger scale integrated electronics. To the user the changes are transparent. You still have 40 track drives and 80 track drives single or double sided with the same corresponding storage capacity for each type. However, the drives are a lot quieter and the track seek times are much improved. I will detail some of the more relevant technical information regarding the 3½ inch drive.

The overall power consumption of a 3½ inch drive is half that of a 5¼ inch drive. This means we can now have two drives running from the BBC micro's internal power supply without fear of it over-loading, or losing data due to reduced voltage within the BBC.

The number of tracks per inch has increased as you might expect. This is the reason for the quieter performance and speedier access times. Track pitch for a 40 track drive is 67.5 TPI, track pitch for the 80 track drive is again double at 135 TPI. A switchable version of the drive is also available.

The 3½ inch drive is completely SA400 bus compatible with the 5¼ inch drive. It can therefore take the place of existing 5¼ inch drives or can be added to existing 5¼ inch drive systems.

Chapter 15

DFS Error Messages

The following is an alphabetical summary of known error messages from the disk filing system.

Bad attribute. Is returned when an illegal character follows the file name for *ACCESS.

Bad command. Is returned when an unrecognised DFS command word, or utility word is given.

Bad directory. Is returned if more than one letter is entered for the *DIR command.

Bad drive. Is returned if the number entered is not in the range 0 to 3, or if the drive number entered is not in the system.

Bad filename. Is returned if the filename used is lower than 1, or higher than 7 characters in length.

Bad option. Is returned if the value given for *OPT is not '1', '2', '3', or '4'.

Can't extend. Is returned if there is insufficient room for data extension on a previously opened file.

Catalogue full. Is returned when an attempt to save more than 31 files to a disk occurs.

Disk changed. Is returned when there is an open file and the disk is changed before closing.

Disk fault. Is returned when a corrupt, damaged, or incorrect type disk is used.

Disk full. Is returned when an attempt to write to a disk that has insufficient room to allocate to the file occurs.

Try *COMPACT to relieve some space but beware of resident programs they may become lost or corrupted.

Disk read only. Is returned when a write command is issued to a disk that is write protected.

Drive fault. Is returned when a normal disk drive function failed.

File exists. Is returned when an attempt to rename an existing file occurs.

File locked. Is returned when a write to a locked file is attempted.

File open. Is returned if you try to delete or open an already open file.

File not found. Is returned if the named file does not exist or is not on the currently selected drive and directory.

File read only. Is returned if you try to write to a read only file opened with OSFIND A=40.

Not enabled. Is returned if the command word *BACKUP or *DESTROY is given without first enabling the command.

Too many open files. Means just that. Only five files can be open at the same time.

If either "**Disk Fault**" or "**Drive Fault**" ever occur there will be an extension to the error message, an example follows:

Disk fault xx AT yy/zz.

Where xx is the fault code, yy is the track number and zz the sector number at which the fault occured.

The most common fault code is 18. This means the diskette is corrupted or unformatted. Fault code 14 could not find track zero. Fault code 16 write error at track/sector.

Appendix A

Maintenance Warning

There are no user servicable parts inside a CUMANA disk drive. Should your disk drive require servicing refer it to qualified service personel, or alternatively, return your disk drive to CUMANA SERVICING CENTRE direct with details of the fault you have experienced.

Risk of Electric Shock

Should you attempt to remove the lid on a CUMANA disk drive be sure to isolate the unit from the mains supply by switching off at the mains and removing the plug from the mains outlet.

Appendix B

Alternative Keyboard Links

Inside the BBC micro and on the keyboard PCB you will find on the right hand side a set of 8 pairs of parallel holes. Looking from left to right the pairs are numbered 1 to 8 as shown in diagram 1 overleaf.

Here we are concerned with links 3, 4 & 5. Links 3 & 4 are used to adjust the track to track stepping speed to suit most disk drives. Link 5 is used to invert the start up or <SHIFT>&<BREAK> Auto boot option.

The following table should be used to select the correct links for your CUMANA drive.

40 Track drive	Link 3 OFF	Link 4 OFF
80 Track drive	Link 3 ON	Link 4 OFF
40/80 switchable drive	Link 3 OFF	Link 4 ON

Links 3 & 4 on together give 4 milliseconds track to track.

Link 3 on & 4 off give 6 milliseconds track to track.

Link 4 on & 3 off give 6 milliseconds.

Links 3 & 4 off, together give 24 milliseconds.

Note: Links 3 & 4 off together refer to the older type full height drives.
Links 4 on and 3 off refer to the switchable disk drives.

Link 5 when made will invert the <SHIFT>&<BREAK> function, i.e., when <BREAK> alone is pressed the disk will auto boot and when <SHIFT> is held while <BREAK> is pressed the normal reset function occurs.

This option is particularly useful if the BBC micro is used in real time situations, where momentary power failure would reset the computer. When the power is restored the drive would reboot the program and restore control over the apparatus, all without user intervention.

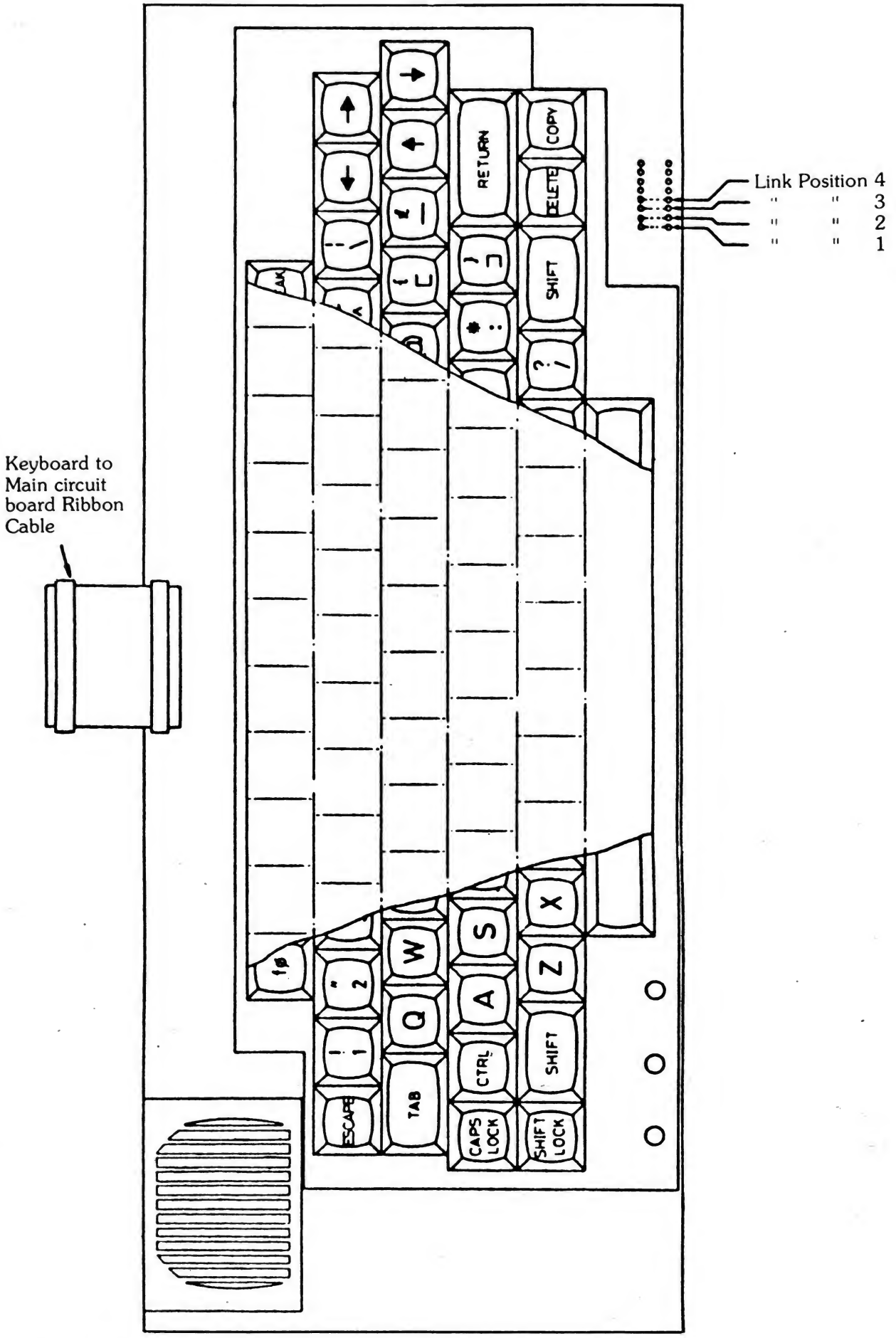


Diagram 1. The BBC Micro, showing the link positions.

Appendix C

Connecting a Second Drive

If you bought a single Cumana disk drive, either 5¼ or 3½ inch, with an internal power supply fitted, with either the UK or European plug, you can easily upgrade to a dual drive system. On the cable that connects your single drive to the host micro computer there is an additional 34 way edge connector. This connector is used to daisy chain another single disk drive to the same type, i.e. if you have a 5¼ inch drive, then the connector will only suit another 5¼ inch drive. The same applies to 3½ inch drives. You can, however, mix 40 and 80 track drives on the same system. All later 80 track drives are switchable to the 40 track mode. If you consider purchasing an 80 track drive to use in the 40 track mode you are advised to immediately read the chapter on switchable drives. (Page 49).

When ordering a second drive for your system, be sure to specify this at the time of placing your order. These models contain the letter "E". This means a disk drive excluding the user guide, connecting cable, and formatter utility disk. The disk drive will also arrive factory preset to drive 1.

Connection

To connect the second drive to your existing system is a simple task. Again, be sure to isolate all units from the mains supply before proceeding. Remove the cover on the second drive by undoing the screws on either side of the lid. Locate the cable entry point at the rear of the unit, here you will find a 34 way cable strain relief fixed by two screws. Remove the screws and the strain relief. Next, locate the second connector on your existing 34 way drive cable and plug it into the rear of the drive mechanism adjacent to the cable entry point. The red or blue indicator stripe on the cable should go to the right hand side of the drive connector. Once this is connected replace the cable strain relief, clamping the cable firmly in place. Lastly, replace the cover and you are ready to use your dual drive system.

If you have any doubts about the fitting of a second drive, refer to a qualified person or alternatively, refer to your dealer who will arrange to have this work carried out on your behalf.